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Exploring Food Supply Chain Resilience: A Systematic Literature Review of Technology and Policy Strategies

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The resilience of the food supply chain has become increasingly significant, particularly in response to global disruptions such as the COVID-19 pandemic. This study systematically reviewed 27 papers from the Scopus database to assess how resilience is measured, focusing on the role of advanced technologies and government policies. Key findings highlight the adoption of blockchain for transparency, the pandemic's role in driving innovation, the critical influence of government policies, and the potential of Industry 5.0 for creating adaptive and sustainable supply chains. While advanced technologies significantly enhance resilience, their impact is maximized when complemented by well-structured government policies. To ensure rigor, the paper selection criteria included relevance, peer-reviewed sources, and a focus on technological or policy-driven interventions. However, this study acknowledges certain limitations. The relatively small sample size of 27 papers may limit the generalizability of the findings. Additionally, while the selection criteria were designed to ensure relevance and quality, expanding the dataset in future research could further enhance the comprehensiveness of the analysis. Future studies should also explore empirical case studies to validate the theoretical insights presented in this review.
Keywords: Blockchain, governance, COVID-19, food supply chain resilience, food policy, agricultural productivity.

INTRODUCTION

The resilience of the food supply chain has become a pressing concern due to global disruptions such as climate change, economic instability, and the COVID-19 pandemic, all of which have exposed critical weaknesses in food distribution networks (Madzík *et al.*, 2024). These challenges highlight the need for a comprehensive approach that integrates technological advancements, strategic supplier selection, and sustainability measures to enhance food supply chain resilience. Emerging technologies, including Industry 4.0, IoT, AI, ML, and blockchain, offer significant potential in improving transparency, traceability, and real-time decision-making, thereby minimizing disruptions and facilitating faster recovery (Aungkulanon *et al.*, 2024). Moreover, supplier selection plays a crucial role in strengthening resilience, with hybrid methodologies like the PROMETHEE II system—combining the Fuzzy Analytic Hierarchy Process and statistical techniques—helping to identify low-risk providers (Sartika *et al.*, 2022). Simulation models further contribute by offering insights into effective strategies such as redundancy, responsiveness, and flexibility, as demonstrated in India's Public Distribution System during the pandemic, where redundancy proved to be the most effective approach.

Beyond technology-driven solutions, broader socio-economic and environmental factors significantly impact food supply chain resilience. Climate change remains a formidable challenge, necessitating adaptation strategies to sustain agricultural productivity and food security (Chen *et al.*, 2022). Policy gaps also hinder resilience efforts, as inadequate regulatory frameworks and ineffective governance can exacerbate vulnerabilities during crises (Kononiuk and Magruk, 2023). Additionally, the socio-cultural dimensions of resilience such as equitable access to food resources and the role of local food systems are often overlooked despite their importance in ensuring long-term sustainability and social stability (Moynihan *et al.*, 2022). Strengthening local food production, supporting small-scale farmers, and implementing sustainable agricultural practices can enhance both resilience and food security, particularly in the face of large-scale disruptions (Kononiuk and Magruk, 2023).

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Resilience, the capacity to endure disturbances, is frequently bolstered by structural attributes like redundancy and diversity. Studies indicate that diversifying suppliers, production locations, and logistical routes can effectively mitigate the risks associated with localized interruptions, thus enhancing resilience (Karanam *et al*., 2024). Furthermore, the use of contemporary technologies such as artificial intelligence (AI), Internet of Things (IoT), and blockchain might enhance the ability to see and predict trends, thereby reinforcing the resilience of the supply chain through proactive risk management (Karanam *et al*., 2024). Logistics and operational strategies play a crucial role in facilitating the speed and effectiveness of recovery, which refers to returning to pre-disruption conditions (Coderoni and Perito, 2020; Mancini *et al*., 2017). Efficient inventory control, adaptable procurement, and transportation logistics are crucial for restoring supply chain operations (Saarinen *et al*., 2024). Utilizing digital technologies, such as Industry 4.0 and AI, is essential for enhancing recovery through optimizing operational efficiency and making real-time adjustments in response to disruptions (Lakhouil and Soulhi, 2024; Sutar *et al*., 2024).

Furthermore, the ability to quickly adjust to changing conditions and effectively collaborate among different entities in the supply chain is crucial for swift recovery. This requires agility and coordination. Adaptability, the capacity to adjust and develop in reaction to enduring modifications, is becoming more critical in light of fluctuating customer preferences, technology progress, and broader economic or climate patterns (García-Madurga and Grilló-Méndez, 2023; Goyal, 2022; Skare *et al*., 2023). Multiple studies highlight the significance of innovation, learning, and strategic flexibility in developing long-term resilience (Reynolds, 2024; Sari *et al*., 2024). Implementing sustainable techniques and ethical sourcing not only increases adaptability but also boosts brand reputation and economic viability (Karanam *et al*., 2024). In addition, the use of digital technologies enhances the flexibility of supply chains to adjust to environmental changes and non-tariff barriers (Nikookar *et al*., 2024). The COVID-19 pandemic has shown the significance of resilience in all three aspects (Xinyue *et al*., 2022). The COVID-19 pandemic has emphasized the necessity for strong and resilient systems that can survive unforeseen disruptions, effective means for recovering operations promptly, and adaptable strategies to handle long-term changes in the supply chain landscape (Li *et al*., 2024; Sutar *et al*., 2024). The pandemic's effect on food supply systems exemplifies the necessity of incorporating contemporary technologies and strategic adaptability to uphold resilience (Li *et al*., 2024).

Various indicators and frameworks have been developed to assess the resilience of food supply chains, focusing on performance, risk, and sustainability. The Supply Chain Operations Reference (SCOR) model is a well-known framework that evaluates performance and risk across the planning, procurement, production, and delivery stages, providing a comprehensive approach to resilience assessment (Sutar *et al*., 2024). In addition, the Resilience Analysis Grid (RAG) and Food Chain Resilience Assessment Framework offer tools to identify weaknesses and opportunities for supply chain resilience improvement (Sutar *et al*., 2024). Indicators for assessing resilience include supply chain performance measures such as lead time, delivery reliability, and cost efficiency, as well as risk measures such as exposure to supply disruptions and supplier reliability (Chae *et al*., 2014; Sommanawat *et al*., 2019). Social and environmental indicators are increasingly being considered, reflecting the broader impact of the supply chain on society and the environment. For example, the framework developed by Okay et al. includes 91 performance indicators, with 36 environmental and 55 social indicators, to assess sustainability performance across the supply chain (Okay *et al*., 2024). In the context of food supply chains, Mohamed and Ismail highlight the importance of identifying and ranking risk factors that affect sustainability, using hybrid multi-criteria decision-making methods to manage uncertainty and improve resilience (Mohamed and Ismail, 2024).

Similarly, Aungkulanon *et al.*, 2024) proposed a hybrid approach that combines the Fuzzy Analytic Hierarchy Process with statistical techniques to improve supplier selection and manage supply chain risks in the agricultural sector (Aungkulanon *et al*., 2024). The integration of modern technologies such as Industry 4.0, IoT, AI, and blockchain is emphasized as essential for improving resilience, as these technologies facilitate better data management and decision-making in dynamic environments (Lakhouil and Soulhi, 2024; Sutar *et al*., 2024). Lakhouil and Soulhi's fuzzy logic model further supports this by incorporating agility, coordination, and innovation, which aligns with the digital transformation of supply chains (Lakhouil and Soulhi, 2024). Although there has been notable advancement in comprehending the resilience of the food supply chain, various areas still need to be addressed, specifically in terms of establishing standardized definitions and measuring frameworks. The research reveals an absence of agreement on universal indicators and procedures that can be universally used across diverse contexts and food supply chains. The lack of a comprehensive and integrated perspective is evident in current research, which concentrates on individual aspects such as transportation or inventory management rather than a holistic and system-wide approach (Aungkulanon *et al*., 2024; Madzik *et al*., 2024). The focus of research has primarily been on the economic and operational aspects of resilience, with scant consideration of social and environmental elements. The exclusion of this aspect is becoming more widely acknowledged as a crucial deficiency, particularly in light of the growing focus on sustainability in supply chain management (Mohamed and Ismail, 2024; Ojo, 2024). For

instance, while certain studies suggest integrating sustainability and risk management methods, they frequently fail to adequately tackle the intricacy of social and environmental factors (Mohamed and Ismail, 2024; Ojo, 2024). Furthermore, the ever-changing and flexible structure of contemporary supply chains, affected by the process of global integration and advancements in technology, necessitates adaptable and comprehensive evaluation models for resilience. Incorporating fuzzy logic models and Industry 4.0 principles provides a sophisticated method for measuring resilience, which considers uncertainty and enhances the significance of assessments in the present-day context (Aungkulanon *et al*., 2024).

While significant research has explored various aspects of food supply chain resilience, gaps remain in understanding how technology, policy, and operational frameworks interact to create a robust and adaptive system. Specifically, there is a need for deeper exploration of (1) how cutting-edge technologies like blockchain, IoT, and AI can be leveraged to enhance resilience; (2) the role of government policies in fostering technology adoption and strengthening supply chain stability; and (3) how these elements can be effectively integrated to develop a comprehensive and adaptive framework for mitigating global supply chain disruptions. Addressing these questions will provide critical insights for building a resilient, sustainable, and inclusive food supply chain that can withstand future crises while ensuring food security for diverse populations.

MATERIALS AND METHODS

***Design research*:** This study uses a systematic review of the literature methodology to examine specific subjects related to prior research. This strategy is widely acknowledged as a highly effective methodology for identifying and exploring new research subjects, as well as for developing and refining theoretical frameworks (Fassam and Dani, 2017). Systematic reviews are well-suited for research that has a narrow focus or aims to provide a comprehensive summary of data in a specific field. The systematic review was verified in this context based on the study questions and objectives (Ali, 2021) This allowed for a literature search on resilient food supply chains.

Furthermore, systematic reviews are widely recognized as a valuable tool in medical research due to its ability to effectively combine and analyze the existing literature in a consistent, transparent, and organized manner (Natalia *et al*., 2023). However, despite the advantages, this approach is hardly employed in business research (Iskandar *et al*., 2022). However, this research demonstrates that it is still a reliable approach for analyzing resilience in the food industry. To produce valid results and develop a research article that can be applied to a broader context, a researcher can achieve this by completing a systematic assessment of existing literature based on a predetermined framework.

According to Klingenberg *et al*. (2021) the initial stage of a systematic literature review involves identifying the objective of the review, which is based on the research question. This study aims to determine the resilience of the food supply chain. Charrois (2015) suggests employing a minimum of two databases for a systematic review. However, in this work, only one Scopus database was utilized for the literature search, and the Internet was used for supplementary material. Identical search terms were employed throughout several databases and the Internet to locate relevant articles

***Literary search queries*:** An extensive search strategy was established to discover pertinent literature on the resilience of food supply chains, including a meticulous selection of search phrases to encompass all relevant studies. The user mentioned key terms such as "Food supply chain resilience," "Supply chain management," and "Supply chain sustainability." The Boolean operators (AND, OR, NOT) were employed to merge the phrases and refine the search outcomes efficiently. The search was restricted to English articles published between 2017 and 2024 to guarantee the incorporation of up-to-date and pertinent research.

Each term was utilized individually within the database. A total of 150 items were retrieved using the provided search keywords. Table 1 displays the criteria for selecting articles for the literature review, including the inclusion and exclusion criteria.

Table 1. Research paper criteria.

Inclusion Criteria	Exclusion Criteria
Peer-reviewed journal articles, conference papers, and review articles.	Articles not published in peer-reviewed journals or conferences.
Studies published in English.	Studies focused on non-food supply chains unless they provide relevant insights for food supply chains.
Research specifically addressing resilience in food supply chains.	Papers that do not specifically address resilience or the application of technology in supply chain management.
Research discussing the application of technology (blockchain, IoT, AI) in enhancing supply chain resilience.	Non-English publications.
Papers published between 2017 and 2023.	
Research with Open Access.	

The inclusion and exclusion criteria ensured that only the most pertinent and superior research was incorporated into the review, enhancing the validity and dependability of the findings.

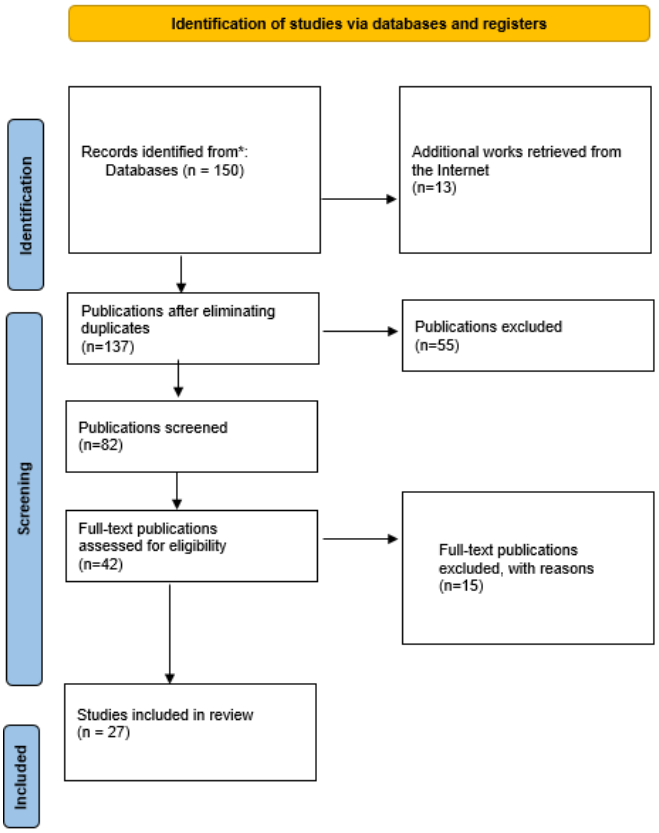

Figure 1. Prisma diagram.

RESULTS

This study aims to investigate the diverse elements that impact the ability of food supply systems to withstand global challenges. The study employed a systematic literature review methodology to identify and analyze policies, technologies, and best practices that can improve the resilience of food supply chains. Figure 2 below illustrates a notable pattern.

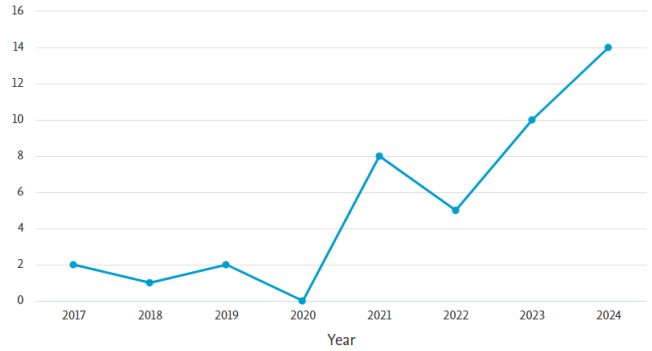

Figure 2. Research trend on food supply chain resilience.

Figure 2 illustrates a substantial increase in research on food supply resilience starting in 2017, as evidenced by the analysis of 27 papers. The affiliations that provide the most contributions to this theme are displayed in Figure 3 below:

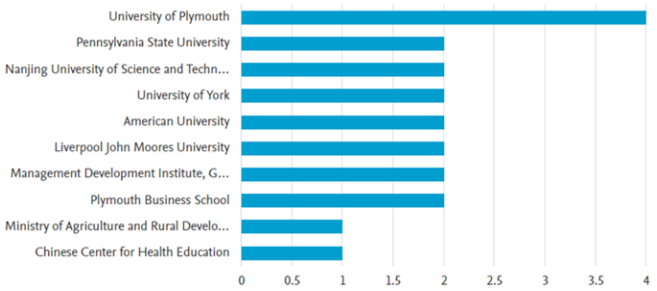

Figure. 3 Affiliate contributors.

Plymouth University stands out with the most significant contribution (about 4.5 documents), demonstrating robust research engagement in this field. On the other hand, Pennsylvania State University, Nanjing University of Science and Technology, University of York, American University, and Liverpool John Moores University produced approximately two documents, suggesting moderate research engagement. The institutions featured in this chart originate from diverse countries, such as the United States, the United Kingdom, and China, demonstrating the worldwide significance of the subject matter. Academic institutions had a higher engagement level than the Ministry of Agriculture and the Chinese Centre for Health Education since they submitted fewer documents, suggesting a more specialized focus or lower involvement.

Table 2. Top countries.

Country	Document
United Kingdom	17
United States	9
China	7
India	5
Australia	3
Canada	3
France	3
Italy	3
Poland	2
Qatar	2

The United Kingdom emerged as the primary contributor, surpassing all other countries regarding the sheer volume of documents. This highlights the UK's substantial dedication and proficiency in this particular domain and underscores the prevalence of UK-based research in related fields of study. The United States pursued this action, demonstrating its robust academic and research infrastructure. China and India contributed significantly, showcasing their increasing importance and involvement in global research. This graph depicts the extensive distribution of research worldwide, with

contributions from countries spanning multiple continents, including Australia, Canada, France, Italy, Poland, and Qatar. This highlights the universal significance of the themes being studied. Poland and Qatar had fewer documents, which may suggest a more focused interest or advancement in research capabilities within the respective regions.

Twenty-seven studies were examined, and the disparities between quantitative and qualitative methodologies are outlined in Table 3.

Table 3. Research approach and key themes

	Methods approach	Key themes
(Abeyratne and Monfared, 2016), (Wamba and Queiroz, 2020), (Grover *et al*., 2018), (Rizou *et al*., 2020), (Lu, 2021), (Xu *et al*., 2021), (Bednar and Welch, 2020), (Woodside, 2017), (Kamble *et al*., 2019), (Chang *et al*., 2020), (Grover *et al*., 2019), (Dubey *et al*., 2022), (Caro *et al*., 2018), (Maddikunta *et al*., 2022)	Qualitative	'Blockchain in global supply chains', "Health and safety policy", "Industry 5.0" "IoT technology" 'Sustainability policy in food supply chains'
(Hobbs, 2020), (Mandal *et al*., 2023), (Pappas and Woodside, 2021), (Freund *et al*., 2022), (Liu and Li, 2020), (Sengupta *et al*., 2022), (Moosavi *et al*., 2022), (Bhardwaj, 2020), (Kantor *et al*., 2024), (Zhao *et al*., 2018).	Quantitative	'FsQCA', 'COVID-19 policy on food supply chains effectiveness of government policies', "digitalization on food supply chain operational efficiency," "technological innovation in emerging markets"

***Pandemic policies and their impact on supply chain*:** The COVID-19 epidemic has compelled governments worldwide to enact emergency measures that impact the operations of the food supply chain (Hobbs, 2021). Hobbs (2020) states that supply chains are directly affected by policies such as factory closures, mobility restrictions, and changes in consumer behavior. These policies create such problems as logistical interruptions and higher operating expenses. Rizou *et al.* (2020) emphasized the significance of workplace health and safety regulations during the pandemic. They highlighted that organizations that fail to adhere to health procedures are at a higher risk of experiencing operational disruptions, which can eventually impact the stability of the supply chain. In addition, Liu and Li (2020) emphasized that policies that support sustainability and safety in food production are gaining importance in the present global scenario, characterized by ongoing pandemic risks. Freund *et al.* (2022) highlight that the pandemic has had a wide-ranging impact on food supply chains, impacting production, distribution, consumer confidence, and global food security. This underscores the necessity for more robust and flexible policies to address similar crises in the future effectively.

***The role of industry 5.0 in the food supply chain*:** Industry 5.0 revolutionizes the management of food supply chains by emphasizing the collaboration between humans and machines (Poo and Yang, 2021). Xu *et al.* (2021) stated that the utilization of technology such as artificial intelligence (AI), big data, and collaborative robots (cobots) enhances the productivity and adaptability of the food supply chain. This enables enterprises to promptly and effectively address fluctuations in customer demand. Lu (2021) highlights that Industry 5.0 goes beyond technology and focuses on restoring the human element in production. Technology is employed to assist rather than replace human workers, which is particularly crucial in food supply chains where worker well-being and safety are of utmost significance. According to Bednar and Welch (2020), the adoption of advanced technologies in Industry 5.0 allows companies to establish supply chains better equipped to withstand external disruptions, such as pandemics or natural disasters. They highlight the significance of integrating these technologies with policies that promote sustainability and innovation.

***Configuration analysis of factors determining food supply chain resilience*:** This study found that various interrelated factors influence food supply chain resilience, including technology, policies, and operational practices. Explains that the configuration approach allows for a more in-depth analysis of how these factors can lead to high resilience in food supply chains. According to Pappas and Woodside (2021), the use of the fuzzy set Qualitative Comparative Analysis (fsQCA) approach in this study enabled the identification of the most practical combination of factors in enhancing resilience, finding that the combination of pandemic-related policies and the application of Industry 5.0 technologies can create a configuration that is resilient to external disruptions. Woodside (2017) adds that there is no one-size-fits-all solution in the context of supply chain resilience. Still, somewhat different combinations of technologies and policies may work better in various contexts, emphasizing the importance of a flexible and adaptive approach in managing food supply chains as a place to recognize any contributions made to the paper that do not meet the criteria for authorship. This may include technical support, gifts received, or organizational assistance.

DISCUSSION

***Integration of blockchain technology and pandemic policy*:** The study findings indicate that using blockchain technology in pandemic policy is crucial for attaining strong resilience in food supply networks. The integration of blockchain technology with sustainability and food safety standards is becoming more significant due to its capacity to enhance

transparency and accountability (Vanditha *et al.,* 2023). Chang *et al.* (2020) asserted that the effective adoption of blockchain technology depends on a policy framework that provides strong support. They stress that the technology's promise to enhance supply chain resilience may not be fully realized without explicit governmental and regulatory backing (Tsiamas and Rahimifard, 2021). Kamble *et al.* (2019) conducted research that confirms the importance of regulations promoting transparency and traceability for the successful use of blockchain technology (Fiss, 2011). This study elucidates that the utilization of the configuration approach enables a comprehensive examination of how the amalgamation of technology and policy might foster resilience. Considering the circumstances, integrating flexible pandemic strategies and utilizing blockchain technology could potentially *enhance the robustness of food supply chains.*

***COVID-19 pandemic as a trigger for innovation in supply chains*:** The COVID-19 pandemic has significantly stimulated innovation in food supply networks (Suali *et al.,* 2024). Tyson Foods, a major meat producer in the United States, has swiftly embraced new technologies like blockchain to enhance the openness and dependability of its supply chain in response to the epidemic (Niknejad *et al.,* 2021). This demonstrates that although the pandemic presents significant difficulties, it also provides possibilities to enhance supply chains through technological advancements (Le, 2023). The research conducted by Sengupta *et al.* (2022) corroborates this perspective, demonstrating that organizations that promptly adjust to emerging technology are more capable of enduring and prospering during the pandemic. According to a study conducted by Moosavi *et al.* (2022), the COVID-19 pandemic has compelled enterprises to reassess their supply chain management strategies, placing greater emphasis on digitalization and the adoption of innovative technology (Moosavi *et al.,* 2022). This implies that innovation serves as both a reactive measure to a crisis and a proactive approach to enhance the durability of the food supply chain in the long run.

***The role of industry 5.0 in enhancing food safety and resilience*:** Industry 5.0 revolutionizes the methods by which firms oversee their food supply chains. Maddikunta *et al.* (2022) stated that using technologies like cobots and AI facilitates enhanced cooperation between humans and machines during production. This not only leads to higher productivity but also improves resilience. According to Xu *et al.* (2021), Industry 5.0 facilitates companies in promptly and effectively adapting to fluctuations in market demand. Utilizing AI and big data enables organizations to make expedited and precise selections, which is imperative in response to the swift volatility in market demand during the pandemic. According to Lu (2021), Industry 5.0 involves more than just technology; it also focuses on restoring human elements to the production process. Worker health and safety are crucial in the context of the food supply chain. These technologies empower firms to establish a more secure and adaptable working environment, enhancing the supply chain's robustness.

***Configuration analysis of factors affecting supply chain resilience*:** The configuration method employed in this study demonstrates that there is no universally applicable technique for attaining resilience in the food supply chain. Alternatively, varying amalgamations of technologies and policies may be more effective in different circumstances. Pappas and Woodside (2021) asserted that fsQCA allows for identifying the optimal mix of elements that enhance resilience. Researchers discovered that implementing both pandemic-related rules and Industry 5.0 technologies can establish a robust configuration that can withstand external interruptions. Woodside (2017) stated that in the context of supply chain resilience, the crucial factors for survival are flexibility and the capacity to react to change swiftly. Consequently, it is imperative for organizations to consistently innovate and adjust their strategy to address emerging difficulties effectively.

***Worker health and safety as a key pillar of resilience*:** Amidst the epidemic, ensuring the well-being and safety of workers is crucial for sustaining the uninterrupted flow of food supply chain operations. Rizou *et al.* (2020) argued that organizations prioritizing worker health and safety are more resilient in the face of operational disturbances. Freund *et al.* (2022) demonstrated that enterprises that enforce rigorous health regulations and offer sufficient healthcare amenities are more inclined to sustain operational stability throughout the pandemic. This underscores the significance of prioritizing the well-being of workers as an integral component of a comprehensive resilience plan.

***Use Cobots and AI in industry 5.0*:** Cobots, also known as collaborative robots and artificial intelligence (AI), significantly enhance the efficiency and adaptability of food supply chains. Sigov *et al.* (2022) stated that cobots facilitate human-machine collaboration in the production process, leading to enhanced productivity and decreased likelihood of human error. Maddikunta *et al.* (2022) stated that employing artificial intelligence (AI) in processing large datasets enables companies to make prompt and precise judgments. This is particularly crucial in a pandemic, where rapid fluctuations in market demand might occur. According to Lu (2021), cobots and AI enhance both productivity and adaptability in firms, allowing them to respond more effectively to changes in their business environment. Ensuring better resilience in the food supply system is crucial.

***The role of IoT in food supply chain digitalization*:** The Internet of Things (IoT) has emerged as a crucial technology in the digitalization of the food supply chain. As per Grover *et al.* (2018), the Internet of Things (IoT) allows for continuous monitoring of environmental conditions and food safety in the whole supply chain. It is crucial to guarantee that

food products are stored and supplied in the most favorable circumstances, minimizing contamination and waste. The study conducted by Wamba and Queiroz (2020) demonstrates that the Internet of Things (IoT) allows organizations to adapt to fluctuations in environmental circumstances promptly. This capability is especially crucial in food supply chains, where perishable goods are frequently involved. Furthermore, IoT facilitates enhanced integration across diverse systems and processes throughout the supply chain, ultimately improving efficiency and resilience.

***The need for digital twins in the decision-making process*:** Digital twins, virtual replicas of tangible entities, are crucial in simulating and testing various scenarios within the food supply chain. Maddikunta *et al.* (2022) assert that employing digital twins enables firms to anticipate and control hazards before their manifestation as tangible issues. According to Xu *et al.* (2021), digital twins enable organizations to enhance production processes and anticipate potential issues in advance. This is particularly crucial in the context of food supply chains, as little disruptions can have a significant impact on the entire system

***Compliance and governance through blockchain*:** Blockchain is crucial not only for the capacity to track and trace products but also for guaranteeing that all participants in the supply chain adhere to relevant norms and regulations. Kamilaris *et al.* (2019) implementing blockchain technology in managing compliance throughout the food supply chain can effectively mitigate the risk of violations and enhance consumer confidence. A study conducted by Grover *et al.* (2019) demonstrates that blockchain technology allows for immediate data collection and verification, which is essential for guaranteeing that all participants in the supply chain comply with rigorous food safety regulations. Furthermore, a study conducted by Caro *et al.* (2018) provides additional evidence that blockchain technology can enhance transparency and accountability throughout the supply chain, leading to an overall improvement in resilience.

***Challenges in implementing industry 5.0 technology*:** Although the advantages of Industry 5.0 technologies in food supply chains are evident, their deployment is not without problems. Dubey *et al.* (2023) identified the primary obstacles as substantial capital expenditure, insufficient infrastructure, and workforce reluctance to embrace change. Xu *et al.* (2021) stated that the effective utilization of these technologies is highly dependent on managerial endorsement and sufficient training for employees to acclimate to novel technology. They stress the significance of adopting a comprehensive and all-encompassing strategy when implementing Industry 5.0 technologies. This approach aims to ensure that all stakeholders in the supply chain may actively engage and reap the advantages of these advancements.

***Recommendation*:** Investigations into the application of blockchain technology in food supply networks show tremendous potential. Several studies demonstrate the capacity of blockchain technology to increase transparency and accountability (Feng *et al*., 2020; Niknejad *et al*., 2021; Shi *et al*., 2023). However, further comprehensive research is needed to understand the variations in its application in different countries, especially in developing countries. This research should include analyses of other cases that identify the elements contributing to success and the problems encountered. In addition, it is crucial to assess the effectiveness of government policies in promoting the application of technologies such as IoT, AI, and blockchain to understand their influence on supply chain resilience (Rogerson and Parry, 2020; Shi *et al*., 2023; Vu and Trinh, 2021).

Figure 4. Implication and suggestion.

Research (Le, 2023; Mohamed *et al*., 2021) on the impact of Industry 5.0 on food supply chain resilience can provide insights into how co-operation between humans and machines can improve long-term resilience. Utilizing artificial intelligence and big data, predictive modeling can effectively identify vulnerabilities and simulate various situations, thereby improving the ability to respond to environmental changes (Yousaf *et al*., 2023). Evaluating the importance of education and training is critical to overcoming resistance to change and insufficient technical skills when applying advanced technologies (Moynihan *et al*., 2022). Integrating the concepts of sustainability and resilience in food supply chain management is essential for developing effective strategies for business (Zhao *et al*., 2018). This research is expected to provide valuable insights for developing successful ways to improve food supply chain resilience through modern technology and appropriate regulations.

***Conclusion*:** This study conducted a comprehensive analysis of existing literature to investigate how the resilience of the food supply chain may be measured. The study specifically examined the incorporation of sophisticated technology and government policies that support the food supply chain. The results emphasize the crucial function that technologies like blockchain, the Internet of Things (IoT), and artificial intelligence (AI) have in improving food supply chains' transparency, efficiency, and flexibility. These technologies offer substantial advantages by enhancing traceability, facilitating instantaneous data sharing, and optimizing decision-making processes, which are crucial for ensuring operational continuity during disruptions.

The review also emphasizes the significant influence of the COVID-19 pandemic on worldwide food supply networks, acting as both a rigorous examination and a driving force for innovation. The epidemic revealed weaknesses in conventional supply chain models, namely those that depend on just-in-time inventory systems. As a result, some firms expedited their implementation of digital technology and transitioned to supply chain strategies that prioritize adaptability, duplication, and purchasing from nearby locations.

Government initiatives have emerged as a crucial aspect in improving the resilience of the food supply chain. Government actions, including financial assistance, legislative modifications, and infrastructural expenditures, played a vital role in reducing the impact of the pandemic on food supply chains. The results indicate that an active and thorough policy framework is required to tackle the underlying reasons for supply chain weaknesses and promote implementing technologies that enhance resilience.

In addition, the study examined the capacity of Industry 5.0 to transform food supply chains by combining human-centered methods with cutting-edge technologies. Industry 5.0 prioritizes cooperation between humans and robots, focusing on sustainability and ethical behaviors while improving the ability of supply chains to withstand disruptions. Nevertheless, obstacles such as exorbitant implementation expenses, inadequate infrastructure, and reluctance to embrace change continue to impede the mainstream acceptance of these technologies.

CRediT author statement: All authors contributed to the conceptualization, methodology, formal analysis, and writing of the manuscript. Yusuf Iskandar led the research design and analysis. Chajar Matari Fath Mala and Windarko conducted the literature review and data collection. Budi Harsanto and Yulistyne Kasumaningrum contributed to the interpretation of findings and manuscript revisions. Iston Dwija Utama provided expertise in technological and policy implications. All authors reviewed and approved the final manuscript.

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